

GCSE Physics (9 – 1)

Specific Heat Capacity 1

Name:

Group:



Instructions

- Read each question carefully before you begin to answer it.
- Use black ink or black ball-point pen for your answers.
- Fill in the boxes at the top of this page with your name and group.
- Attempt to answer every question in the booklet.
- Answer the questions in the spaces provided – there may be more space than you need in some answer spaces.
- Calculators may be used for this booklet.
- For any calculations, you **must** show all your working.
- Any and all drawings or graphs should be completed in pencil.

For markers use	
Question	Mark
1	/5
2	/12
3	/5
4	/9
5	/5
6	/6
Total	/46
%	
Grade	

Information

- The maximum mark for this paper is 46 marks.
- The marks for each question are shown in brackets.
- Please be aware that good English and clear presentation are required in your answers.



1. Not all materials heat up at the same rate, the specific heat capacity of a material explains why some materials heat up quickly while some take a lot longer to heat up.

For each of the following questions **circle** the letter of the correct answer.

- a) Which of the following is the correct definition of specific heat capacity?

- A** The energy required to change the state of 1 kg of a substance.
- B** The energy required to raise the temperature of 1 kg of a substance by 1°C.
- C** The energy required to heat a substance until it boils.
- D** The energy contained within the particles of a substance.

(1 mark)

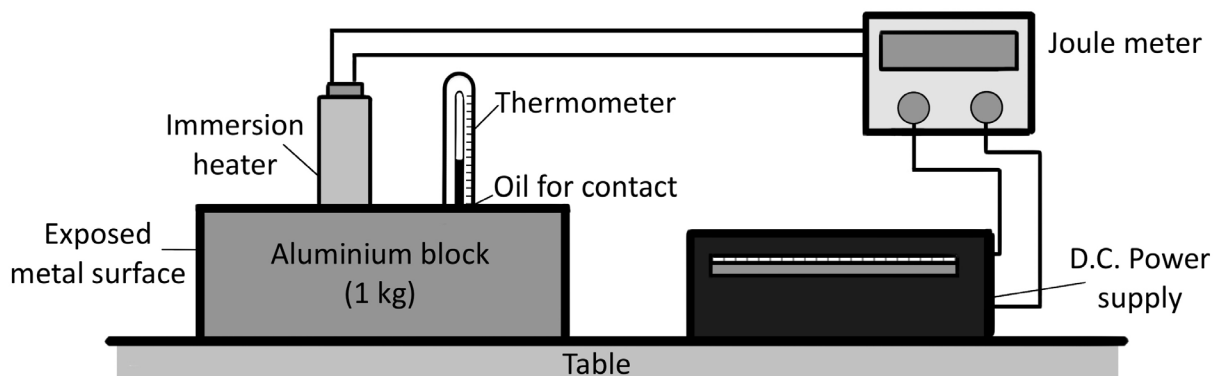
- b) What is the standard unit for specific heat capacity?

- | A | B | C | D |
|----------|----------|----------|----------|
| J | J/kg | J/kg°C | °C |

(1 mark)

- c) A student uses the apparatus shown in the diagram below to determine the specific heat capacity of an aluminium block.

The student calculates the specific heat capacity using the formula.
However, they forget to place insulation around the metal block.



How will this error affect the calculated value of the specific heat capacity compared to the true value?

- A** The calculated value will be lower because the metal heats up faster than expected.
- B** The calculated value will be higher because more energy is transferred to the surroundings, meaning more energy is required to raise the temperature.
- C** The calculated value will be accurate because the specific heat capacity is a constant property of the material and does not change.
- D** The calculated value will be lower because the final temperature recorded will be higher than it should be.

(1 mark)

- d) A block of copper has a mass of 2 kg. The specific heat capacity of copper is 390 J/kg°C. How much energy is needed to increase its temperature by 10°C?

A	B	C	D
780 J	3,900 J	7,800 J	78,000 J

(1 mark)

- e) A substance with a very **high** specific heat capacity means that:

- A** It heats up very quickly with little energy.
- B** It requires a large amount of energy to change its temperature.
- C** It is a good thermal conductor.
- D** It cannot boil.

(1 mark)

(Total for Question 1 is 5 marks)

2. Use the specific heat capacity equation: $\Delta E = m \times c \times \Delta\theta$ to solve the following four questions, showing your full working for each one.

a) A beaker contains 2 kg of water.

Calculate the energy required to raise the temperature of the water from 20 °C to 50 °C.

(Specific heat capacity of water = 4200 J/kg °C)

Specific heat capacity of water = ... J

(3 marks)

b) A block of aluminium has a mass of 0.5 kg. When 9000 J of thermal energy is supplied to the block, its temperature rises by 20°C. Calculate the specific heat capacity of aluminium.

Specific heat capacity of water = ... J

(3 marks)

c) A brick has a specific heat capacity of 840 J/kg °C.

Calculate the mass of the brick if it requires 12600 J of energy to increase its temperature by 5°C.

Mass = ... kg

(3 marks)

d) An iron block with a mass of 500 g is heated.

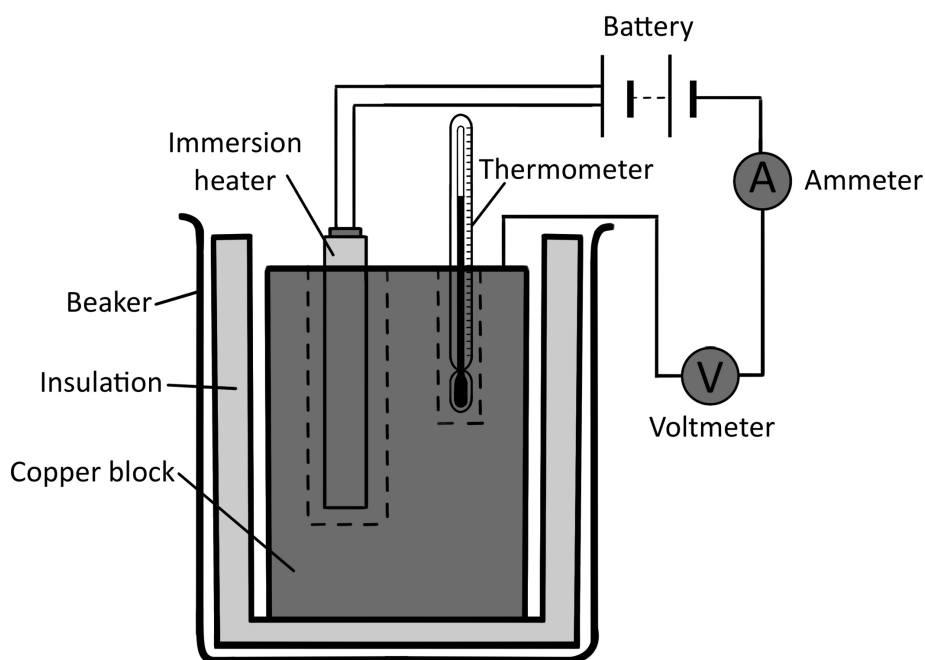
Calculate the energy transferred to the block to increase its temperature by 10°C. Specific heat capacity of iron = 450 J/kg° C

Energy = ... J

(3 marks)

(Total for Question 2 is 12 marks)

3. A student carries out an experiment to determine the specific heat capacity of a copper block using an immersion heater. The figure below shows some of the setup used by the student.



The student connects the immersion heater to a power supply.

The immersion heater has a power output of 50 W. The mass of the copper block is 1.5 kg.

The student switches on the heater for 10 minutes.

During this time, the temperature of the block increases from 20°C to 38°C.

Calculate the specific heat capacity of the copper.

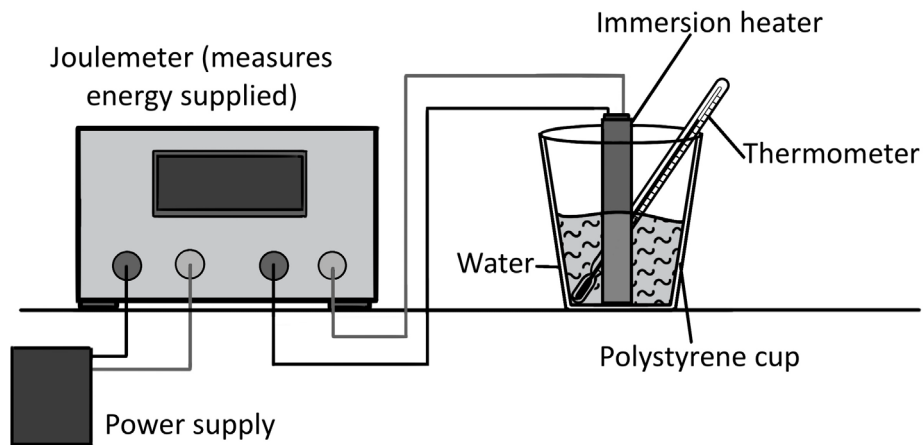
Use the correct physics equation and give your answer to 2 significant figures.

Specific heat capacity of copper = ... J/kg °C

(5 marks)

(Total for Question 3 is 5 marks)

4. A student sets up an experiment as shown in the figure below to find the specific heat capacity of some a vegetable oil.



- a) State the four measurements the student must record to be able to calculate the specific heat capacity of the vegetable oil.

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(4 marks)

- b) State **two** changes the student could make to the apparatus to reduce heat loss and improve the accuracy of the experiment.

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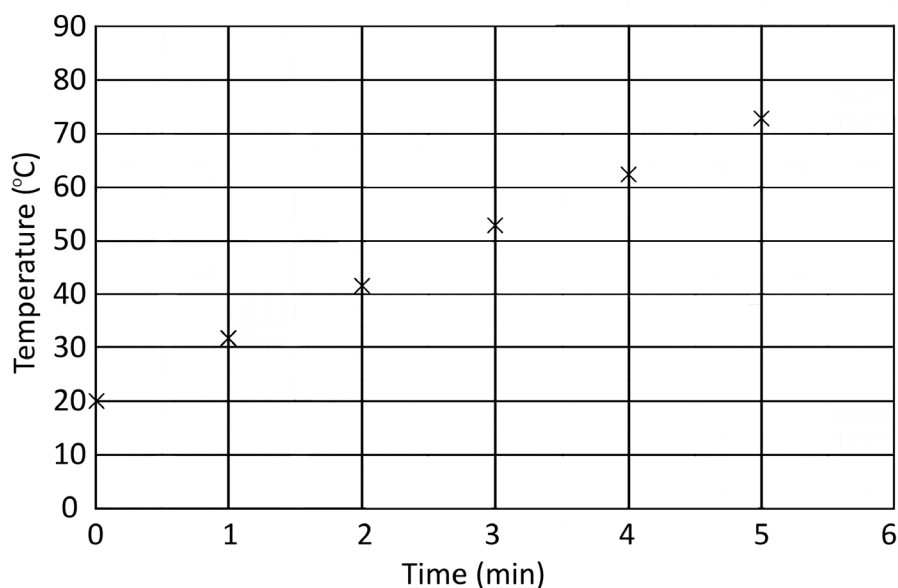
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(2 marks)

The student records the temperature of the oil every minute while the heater is switched on. The graph below shows the student's results.



- c) Use the graph of the student's results to predict the temperature of the vegetable oil if the heating continues up to 10 minutes.

Temperature = ... °C
(1 mark)

- d) Suggest why the actual temperature of the oil at 10 minutes might be lower than the value you predicted in part (c).

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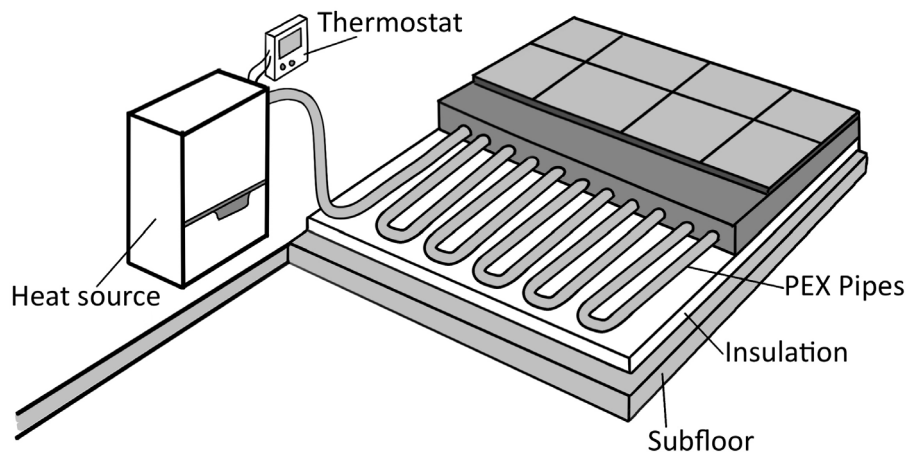
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(2 marks)

(Total for Question 4 is 9 marks)

5. The figure below shows a cross-section of an underfloor heating system.



- a) Hot water flows through pipes embedded in a concrete floor.
The heat from the water warms the concrete.
The water supplies 45 kJ of thermal energy to a section of the concrete floor.
The mass of this section of concrete is 12 kg. The specific heat capacity of concrete is 900 J/kg °C.
Use this data to calculate the increase in temperature of the concrete.

Increase in temperature = ... °C
(3 marks)

- b) The actual temperature increase of the concrete will be smaller than the value in part (a).
Explain why the actual temperature increase will be smaller.

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(2 marks)

(Total for Question 5 is 5 marks)